DESCRIPTION OF OPERATIONS

Shipboard Research:

For the fifth consecutive year, the cruise was conducted aboard the chartered Russian research vessel R/V *Yuzhmorgeologiya*.

Itinerary

Leg I:	Depart Punta Arenas	08 January 2000
	Calibrate in Leith Harbor, South Georgia	12 January
	CCAMLR 2000 survey	13 January-04 February
	Resupply Cape Shirreff camp	05 February
	Cape Shirreff survey	06-10 February
	Recover personnel from Copacabana camp	12 February
	Arrive Punta Arenas	15 February
Leg II:	Depart Punta Arenas	18 February
	Transfer personnel and supplies at Cape Shirreff	21 February
	Calibrate at Cape Shirreff	21 February
	Large-area survey (Survey D)	22 February-07 March
	Calibrate at Admiralty Bay	07 March
	Close Copacabana camp	08 March
	Close Cape Shirreff	09 March
	Arrive Punta Arenas	12 March

Leg I.

1. The R/V *Yuzhmorgeologiya* departed Punta Arenas, Chile en route to South Georgia.

2. The acoustic transducers were calibrated in Leith Harbor, South Georgia. The transducers, operating at 38 kilohertz (kHz), 120kHz, and 200kHz, were hull-mounted and down-looking. Standard spheres were positioned beneath the transducers via outriggers and monofilament line. The beam patterns were mapped, and system gains were determined. In addition, a specially-outfitted Zodiac was launched and acoustic sensors, navigation systems, and safety equipment were tested in preparation for a survey off Cape Shirreff later in the cruise.

3. A multi-national, multi-ship survey of Antarctic krill and whales organized by CCAMLR and the International Whaling Commission (IWC), known as the CCAMLR 2000 survey, was conducted across the Scotia Sea (Figure 2). Other vessels participating in the survey were the R/V *James Clarke Ross* (United Kingdom), the R/V *Kaiyo Maru* (Japan), and the R/V *Atlantida* (Russia). Survey components included acoustic mapping of zooplankton, direct sampling of zooplankton, Antarctic krill demographics, and marine mammal and bird observations. Also, physical oceanography and phytoplankton observations were obtained.

4. Continuous environmental data were collected throughout Leg I, which included measurements of ship's position, sea surface temperature and salinity, fluorescence, air temperature, barometric pressure, relative humidity, wind speed, and wind direction.

5. The ship visited the Cape Shirreff field camp to deliver provisions and supplies.

6. A high-resolution survey for krill and oceanographic conditions was conducted in the vicinity of Cape Shirreff (Figure 3). A specially-outfitted Zodiac conducted a series of acoustic transects, CTD deployments and underwater video observations within 15 miles of Cape Shirreff. The ship complemented these measurements on a coarser grid further offshore, deploying an Isaacs-Kidd Midwater Trawl (IKMT).

7. The ship rendezvoused with the R/V *James Clark Ross* near Deception Island; zooplankton samples collected during the CCAMLR 2000 survey were passed to British Antarctic Survey colleagues for permanent archiving in Cambridge.

8. The ship visited the Copacabana field camp at Admiralty Bay, King George Island to retrieve four personnel.

Leg II.

1. The R/V *Yuzhmorgeologiya* departed Punta Arenas, Chile via the eastern end of the Strait of Magellan and arrived at Cape Shirreff to deliver supplies and personnel to the field camp.

2. The acoustic transducers were calibrated while the ship was at anchor near Cape Shirreff.

3. A large-area survey of 97 Conductivity-Temperature-Depth (CTD) and net sampling stations, separated by acoustic transects, was conducted in the vicinity of Elephant, Clarence, King George, and Livingston Islands (Survey D, Figure 4). Stations are located in three areas: stations to the west of Livingston and King George Islands are designated the "West area," those to the south of King George Island are designated the "South area," and those around Elephant Island are called the "Elephant Island area". Acoustic transects were conducted at 10 knots, using hull-mounted 38kHz, 120kHz, and 200kHz down-looking transducers. Operations at each station included: (a) vertical profiles of temperature, salinity, and oxygen, and measurements of chlorophyll at 5 meters depth; and (b) deployment of an IKMT to obtain samples of zooplankton and micronekton.

4. Optical oceanographic measurements were conducted, which included weekly SeaWiFS satellite images of surface chlorophyll distributions and *in-situ* light spectra profiles.

5. As on Leg I, continuous environmental data were collected throughout the second leg.

6. Following the completion of Survey D, the acoustic transducers were calibrated in Ezcurra Inlet, Admiralty Bay, and King George Island. The Copacabana field camp was closed and field personnel were retrieved. The ship then transited to Cape Shirreff to embark personnel and close the field camp.

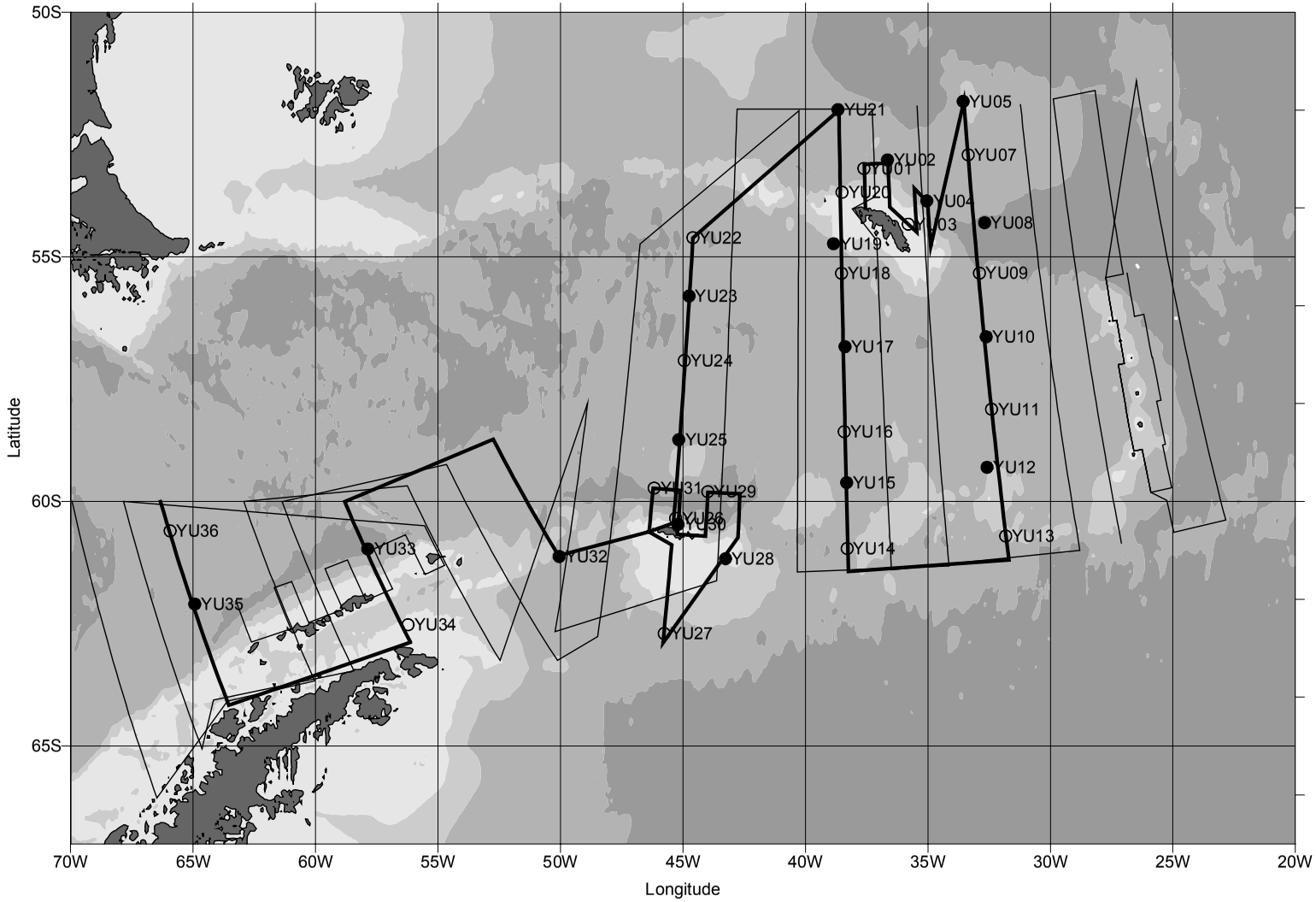

Figure 2. CCAMLR 2000 Survey. Heavy line describes trackline of R/V *Yuzhmorgeologiya*. Open circles represent day-time stations; closed circles represent night-time stations. Light lines represent tracklines of other ships involved in the CCAMLR 2000 Survey (British R/V *James Clark Ross*, Japanese R/V *Kaiyo Maru*, and Russian R/V *Atlantida*). See Report of Bo Workshop, SC-CAMLR-XIX, 2000, CCAMLR, Hobart, Australia for more details. Depth shading is 0-500m, 500-2000 m, 2000-4000m, and greater than 4000 m.

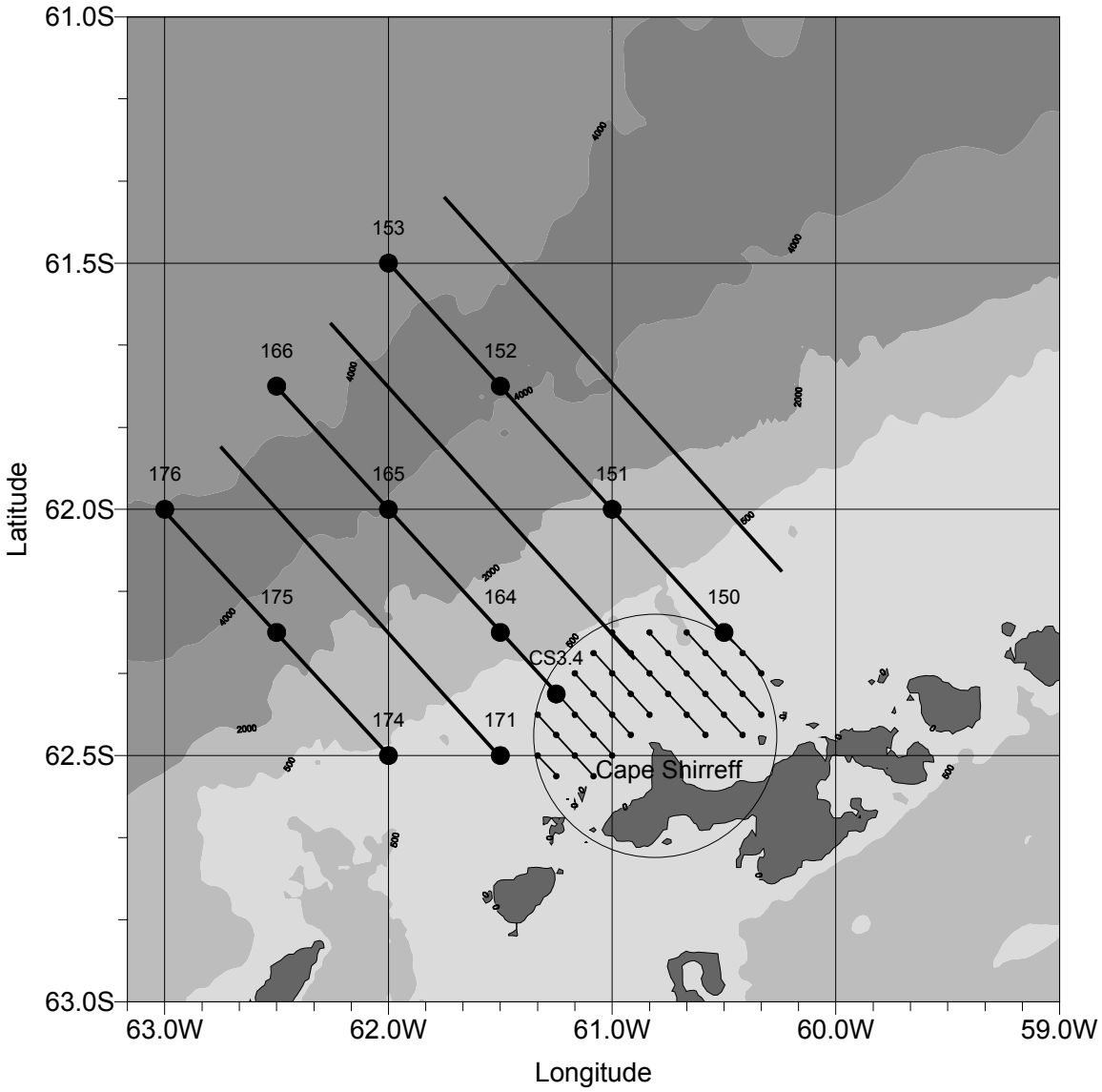

Figure 3. Cape Shirreff inshore survey area. Depth shading is 0-500m, 500-2000m, 2000-4000m and greater than 4000m.

Land-based Research:

Cape Shirreff

1. A four-person field team (M. Goebel, T. Carten, M. Rutishauser, and M. Taft) arrived at Cape Shirreff, Livingston Island, on 31 October 1999 via the R/V *Lawrence M. Gould*. Equipment and provisions were also transferred from the R/V *Lawrence M. Gould* to Cape Shirreff.

2. Two additional personnel (R. Holt and B. Parker), along with supplies and equipment, arrived at Cape Shirreff via the R/V *Lawrence M. Gould* on 22 December 1999. D. Costa arrived at Cape Shirreff via the Aurora Expeditions tour ship, M/V *Prof. Molchanov* on 29 January 2000. Two personnel (D. Demer and A. Jenkins) from the R/V *Yuzhmorgeologiya* visited Cape Shirreff from 5 to 10 February 2000 while they conducted an inshore acoustic survey. N. Gales arrived via the R/V *Yuzhmorgeologiya* on 21 February 2000.

3. Camp maintenance at Cape Shirreff included painting of interior and exterior of camp structures, interior construction of the emergency shelter/bird observation blind, construction of a deck on the storeroom and main hut, and upgrades to electrical fixtures.

4. The annual census of active gentoo penguin nests was conducted on 26 November 1999, and a similar census of chinstrap penguin nests was completed on 30 November 1999. Reproductive success was studied by following a sample of 100 chinstrap penguin pairs and 50 gentoo penguin pairs from egg laying to crèche formation.

5. Radio transmitters were attached to 18 chinstrap penguins on 2 and 3 January 2000; these instruments were used to determine foraging trip duration during the chick-rearing phase. All data were received and stored by a remote field computer set up at the bird observation blind.

6. Five satellite-linked transmitters were deployed on adult chinstrap penguins on 8 January to determine foraging location.

7. Diet studies of chinstrap and gentoo penguins during the chick-rearing phase were initiated on 4 January 2000 and continued through 8 February 2000. Chinstrap and gentoo adult penguins were captured upon returning from foraging trips, and their stomach contents were removed by lavaging.

8. A count of all gentoo penguin chicks was conducted on 4 February 2000, and for chinstrap penguin chicks on 8 February 2000. Fledging weights of chinstrap penguin chicks were collected 16-24 February 2000. Two hundred gentoo penguin chicks were also weighed on 10 February 2000.

9. One thousand chinstrap penguin chicks and 200 gentoo penguin chicks were banded for future demographic studies.

10. Reproductive studies of brown skuas and kelp gulls were conducted around the Cape.

11. Time-depth recorders (TDRs) were deployed on chinstrap and gentoo penguins for 10-12 day foraging periods to study diving behavior.

12. Antarctic fur seal pups and female fur seals were counted at four main breeding beaches every other day from 2 November 1999 through 9 January 2000.

13. Attendance behavior of female Antarctic fur seals was measured using radio transmitters. Twenty-four lactating female seals were instrumented 5-12 December 1999, and their pups were captured, weighed, and measured.

14. U.S. researchers assisted Chilean scientists in collecting data on Antarctic fur seal pup growth. Measurements of mass, length, and girth for 100 pups were begun on 16 December 1999 and continued every two weeks until 5 March 2000.

15. Information on Antarctic fur seal diet was collected using three different methods: scat collection, enemas of captured animals, and fatty-acid signature analyses of milk.

16. Antarctic fur seals were instrumented with TDRs for diving behavior studies.

17. Antarctic fur seal females were instrumented with ARGOS satellite-linked transmitters for studies of foraging locations and energetics. Some of these fur seals also received injections of doubly-labeled water for measurements of metabolic rate, water flux, and energy expended.

18. Five hundred Antarctic fur seal pups were tagged at Cape Shirreff by U.S. and Chilean researchers for demography studies.

19. Weather data recorders were set up at Cape Shirreff for wind speed, wind direction, barometric pressure, temperature, humidity, and rainfall.

20. One team member (T. Carten) left Cape Shirreff via a Chilean Navy vessel on 23 February 2000. Two personnel (D. Costa and N. Gales) were retrieved from Cape Shirreff via the M/V *Prof. Molchanov* on 24 February 2000.

21. The Cape Shirreff field camp was closed for the season on 9 March 2000; all personnel (M. Goebel, M. Rutishauser, M. Taft, R. Holt, and B. Parker), garbage, and equipment were retrieved by the R/V *Yuzhmorgeologiya*.

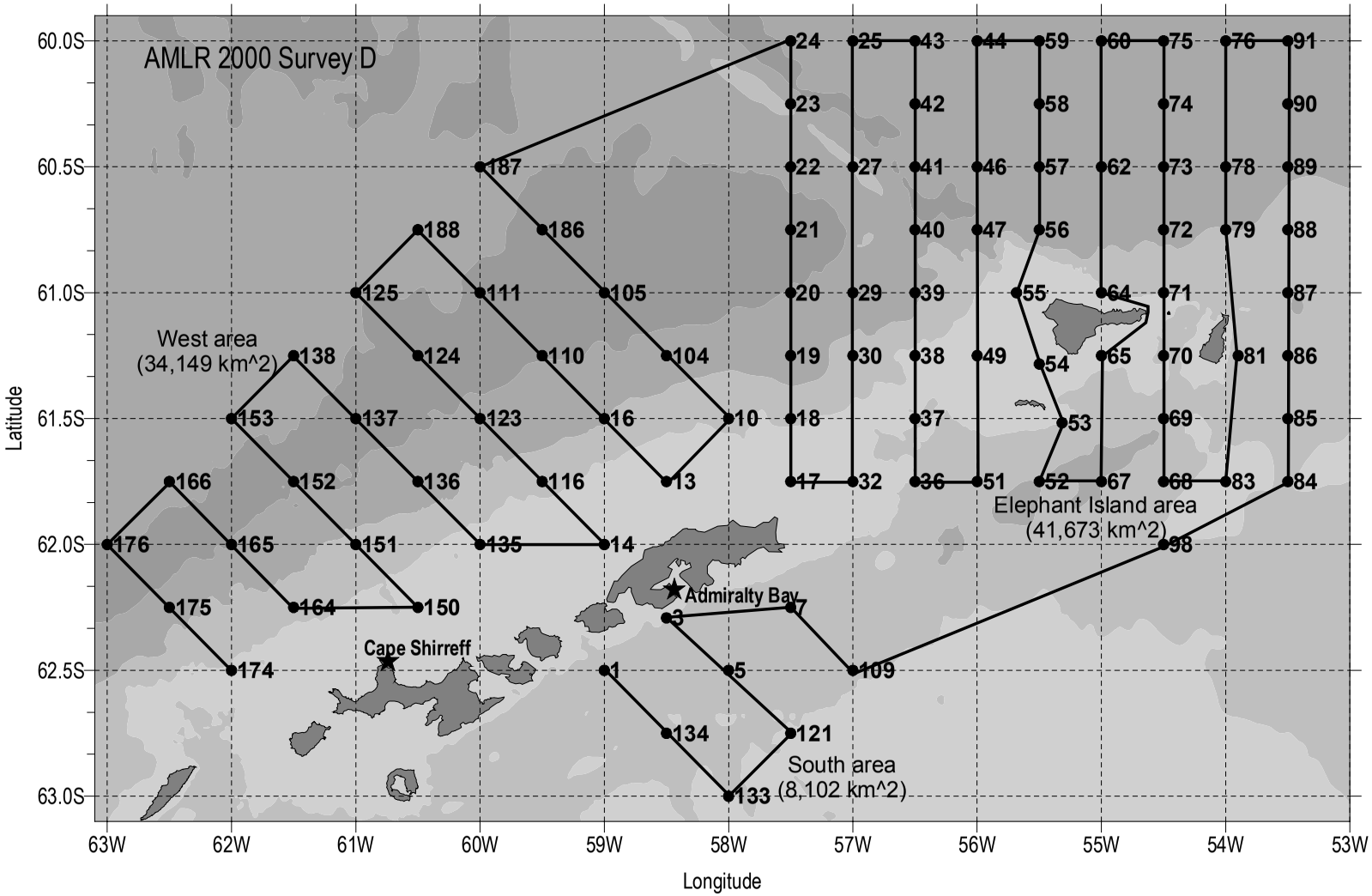

Figure 4. The large-area survey for AMLR 2000 (Survey D) in the vicinity of Elephant, Clarence, King George and Livingston Islands. Stations located to the west of Livingston and King George Islands are designated the "West area", those to the south of King George Island are designated the "South area" and those around Elephant Island are designated the "Elephant Island area". Depth shading is 0-500m, 500-2000m, 2000-4000m and greater than 4000m.